

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Tsujimichi, et al.
Serial No.: 10/625,272
Filed: July 23, 2003
Art Unit: 1754
Examiner: Edward M. Johnson
Confirmation No.: 8414
Title: **PHOTOCATALYTIC HYDROPHILIFIABLE MATERIAL**

AMENDMENT AND RESPONSE TO OFFICE ACTION

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In response to the Office Action dated 21 September 2007, please amend the above-identified application as follows:

Amendments to the Specification begin on page 2 of this paper.

Amendments to the Claims are reflected in the claim listing which begins on page 3 of this paper.

Remarks and Discussion begin on page 7 of this paper.

Applicant is requesting / filing a two-month extension of time concurrently herewith.

IN THE SPECIFICATION:

Please amend the specification as indicated below, in which deleted terms are shown with strikethrough or double brackets, and added terms are shown with underscoring.

Please amend Paragraph at page 1, lines 3-7 as follows.

This is a division of Application Ser. No. 09/772,048, filed Jan. 29, 2001, hereby incorporated herein by reference, which is a division of Application No. 09/380,946, filed Sep. 9, 1999, and claims the benefit of International Application No. ~~PCT/JP00/03705~~ PCT/JP98/03705, which has the international filing date of Aug. 21, 1998 and which was not published under PCT Article 21(2) in English.

IN THE CLAIMS:

Please amend the claims as indicated below, in which deleted terms are shown with strikethrough or double brackets, and added terms are shown with underscoring. Also, please add new claim 67 as shown below.

Claims 1-52 (canceled).

Claim 53 (currently amended): A method for cleaning air, comprising the steps of:

contacting air with the surface of a composite material which is exposed to light; and
contacting the surface of the composite material with water, said composite material comprising at least a substrate and a surface layer ~~on one side of said substrate~~, said surface layer being hydrophilic and self-cleanable, said surface layer comprising three components comprising:

a component (i) comprising a photocatalyst which functions as a catalyst upon exposure to light;

a component (ii) comprising at least one metal oxide selected from the group consisting of Al_2O_3 , ZnO , SrO , BaO , MgO , CaO , Rb_2O , Na_2O , K_2O , and P_2O_5 ; and

a component (iii) comprising at least one metal oxide selected from the group consisting of SiO_2 , ZrO_2 , GeO_2 , and ThO_2 ;

wherein components (i), (ii) and (iii) are all situated within said surface layer which is provided as a single surface layer, such that all of said components are in close proximity to one another within the single surface layer.

Claim 54 (original): A method according to claim 53, wherein the composite material satisfies

a/(a+b) of about 0.0001 to about 0.8, wherein a represents the weight of the metal oxide as the component (ii) and b represents the weight of the photocatalyst as the component (i).

Claim 55 (original): A method according to claim 53, wherein the photocatalyst as the component (i) and the metal oxide as the component (ii) are contained in the form of particles having a diameter of about 0.005 to about 0.5 microns.

Claim 56 (currently amended): A method according to claim 53, wherein the composite material further comprises a component (iv), in said surface layer ~~on one side of said substrate~~, comprising at least one antimicrobial metal selected from the group consisting of zinc, silver, and copper, and wherein the antimicrobial metal as the component (iv) is supported on the photocatalyst as the component (i).

Claim 57 (currently amended): A method according to claim 53, wherein the surface layer ~~on one side of said substrate~~ further comprises at least one metal selected from the group consisting of silver, copper, palladium, iron, nickel, chromium, cobalt, platinum, gold, rhodium, and ruthenium.

Claim 58 (currently amended): A method according to claim 53, wherein the surface layer ~~on one side of said substrate~~ further comprises at least one metal selected from the group consisting of lithium, calcium, magnesium, and aluminum in an amount effective for improving the hydrophilicity.

Claim 59 (original): A method according to claim 56, wherein the composite material satisfies c/d of about 0.00001 to about 0.05 wherein c represents the weight of the component (iv) and d represents the weight of the photocatalyst as the component (i).

Claim 60 (original): A method according to claim 53, wherein the surface layer has a geometry satisfying any one of the following requirements (1) and (2):

- (1) thickness of the surface layer is about 0.01 to about 3.0 microns; and
- (2) difference in color ΔE of the surface layer between before ultraviolet irradiation and after ultraviolet irradiation of the surface layer, with a 1% silver nitrate solution deposited thereon, for 5 min at an ultraviolet intensity on the surface layer of 1.2 mW/cm^2 , is 1 to 50.

Claim 61 (original): A method according to claim 53, wherein the composite material has a binder which is interposed between the substrate and the surface layer.

Claim 62 (original): A method according to claim 61, wherein the binder is polymerizable or meltable below a temperature at which the substrate is deformed, to fix the surface layer onto the substrate.

Claim 63 (original): A method according to claim 62, wherein the binder is a glaze or a paint.

Claim 64 (original): A method according to claim 53, wherein the substrate is a tile.

Claim 65 (original): A method according to claim 53, wherein the substrate is an earthenware, a

wood, a calcium silicate material, concrete, a cement board, a cement extruded board, a plaster board, or an autoclave light-weight concrete board.

Claim 66 (currently amended): A method according to claim 53, wherein the composite material has an antimicrobial metal or a metal compound which is anchored on the surface of the surface layer ~~on one side of said substrate~~.

Claim 67 (new): The method of claim 53, wherein the components (i), (ii) and (iii) are all substantially intimately mixed and dispersed in the single surface layer.

REMARKS AND DISCUSSION

Upon entry of the present amendment, Claims 53-67 remain in the application, of which, Claim 53 is independent. New dependent claim 67 is also being added by the present amendment. The specification is amended to correct the serial number of the International Application from which the present application is derived.

The above-identified Office Action has been reviewed, the references carefully considered, and the Examiner's comments carefully weighed. In view thereof, the present Amendment is submitted. It is contended that by the present amendment, all bases of rejection set forth in the Office Action have been traversed and overcome. Accordingly, reconsideration and withdrawal of the rejection is respectfully requested.

Amendments Presented

Applicant has amended claims 53, 56, 57, 58, and 66 herein, to delete the phrase “on one side of said substrate” that was objected to by the Examiner. Applicant has also amended claim 1 to further specify that components (i), (ii) and (iii) are all situated within said surface layer which is provided as a single surface layer, such that all of said components are in close proximity to one another within the single surface layer.

New claim 67 is being added by the present amendment, and this claim depends from claim 53 and adds the further limitation that the components (i), (ii) and (iii) are all substantially intimately mixed and dispersed in the single surface layer.

Applicant respectfully submits that the above amendments are fully supported throughout the originally filed specification, including the drawings and the discussion of the preparation of the photocatalyst formulations and the use of same in forming photocatalytic materials according to the invention at pages 25-26 of the original specification. No new matter is added by these

amendments, since all of the subject matter thereof was fully supported by the specification as originally filed, such as, for example, by page 21 lines 15 through 20.

The claimed invention is directed to a method for cleaning air. The method involves the use of a composite comprising a substrate and a single surface layer. The surface layer is hydrophilic and self-cleanable, and comprises three components. The three required components are: (1) a photocatalyst, (2) a component comprising a first metal oxide selected from a first Markush group, and (3) a component comprising a second metal oxide selected from a second Markush group. The above three components are all situated within the surface layer which is provided as a single surface layer, such that all of the components are in close proximity to one another within the single surface layer.

This close proximity is believed to provide superior functionality as used in applicant's claimed method, as extensively discussed throughout the original application.

Section 112 Issues

In item 2 of the Office Action, the Examiner rejected claims 53-66 under 35 USC 112 as failing to comply with the written description requirement. The Examiner took the position that in his view, the most recent amendment added subject matter which was not described in the original specification. The Examiner maintained that in his view, no support was found in the original disclosure for the surface layer being "on one side".

Applicant traverses the rejection under section 112, and respectfully points out that paragraph [0026] of the specification specifically states that the claimed photocatalytic layer is present "on the surface of inner or outer walls" of a building. This clearly indicates that the layer is on one side of a substrate.

However, in the interest of expediting prosecution, applicant has amended the claims to

remove the objected-to language.

Applicant respectfully submits that as presently amended, each of the pending claims is in full compliance with the requirements of section 112. Applicant therefore requests reconsideration and withdrawal of the rejection of claims 53-66 under 35 USC 112.

Section 102 Issues

In item 4 of the Office Action, the Examiner rejected claims 53-54, 56-58, 60 and 66 under 35 USC 102(e) as anticipated by, or in the alternative, under 35 USC 103(a) as obvious in light of *Komatsu et al.*, U.S. 5,854,708.

Applicant traverses this ground of rejection, and requests reconsideration and withdrawal thereof because *Komatsu* neither anticipates nor makes obvious the claimed invention.

The Standard for Anticipation

In the case of ***Motorola, Inc. v. Interdigital Technology Corp.***, 121 F. 3d 1461 (CAFC 1997), the Court of Appeals for the Federal Circuit stated:

“For a prior art reference to anticipate a claim, the reference must disclose each and every element of the claim with sufficient clarity to prove its existence in the prior art (citation omitted). ‘The (prior art) reference must describe the applicant’s claimed invention sufficiently to have placed a person of ordinary skill in the field of the invention in possession of it’ (citations omitted). Although this disclosure requirement presupposes the knowledge of one skilled in the art of the claimed invention, that presumed knowledge does not grant a license to read into the prior art reference teachings that are not there.”

The above-quoted passage is consistent with many previous cases of the Federal Circuit and with MPEP 2131, which reiterate the rule that **in order to anticipate a claim, a reference must teach every element of the claim.**

Applicant respectfully submits that *Komatsu* does not disclose each and every element of applicant’s claimed invention. Specifically, *Komatsu* fails to teach, disclose, suggest or render

obvious applicant's claimed structure in which components (i), (ii) and (iii) are all situated within said surface layer which is provided as a single surface layer, such that all of said components are in close proximity to one another within the single surface layer.

Komatsu discloses an anti-fog element on a substrate (col. 2, lines 8-13). The anti-fog element is comprised of two films or layers, with one provided on a surface of the other: an inner photocatalyzer film, and an outer inorganic oxide film on the photocatalyzer film. (Id.) An example of a material for the photocatalyzer film is TiO₂. (Id. at col. 2, lines 40-44.) An example of a material for the inorganic oxide film is silica. (Id. at col. 2, lines 33-39.) Another, alternative example of a material for the inorganic oxide film is alumina. (Id.)

In this regard, applicant also respectfully submits that Komatsu does not disclose using a *mixture of SiO₂ and Al₂O₃*, nor does it disclose using any mixture of inorganic oxides for the inorganic oxide film. Likewise, Komatsu does not disclose any applicable three-component structure formed on a substrate, or any applicable triple-layer structure on a substrate for the anti-fog element. As such, it cannot form the basis for a rejection of claims 53-54, 56-58, 60 and 66 under §102. See, e.g., **Rapoport v. Dement**, 254 F.3d 1053, 1057 (Fed. Cir. 2001); **Gechter v. Davidson**, 116 F.3d 1454, 1457 (Fed. Cir. 1997); MPEP § 2131.

In fact, rather than teaching the elements of applicant's claim, Komatsu actually teaches away from applicant's claimed invention because (for example) Komatsu necessarily requires multiple films or layers.

Teaching Away

The Court of Appeals for the Federal Circuit has established that a prima facie case of obviousness can be rebutted if the applicant . . . can show 'that the art in any material respect taught away' from the claimed invention." ***In re Geisler***, 116 F.3d 1465, 1469, 43 USPQ2d

1362, 1365 (CAFC 1997). "A reference may be said to teach away when a person of ordinary skill, upon reading the reference, . . . would be led in a direction divergent from the path that was taken by the applicant." *Tec Air, Inc. v. Denso Mfg. Mich. Inc.*, 192 F.3d 1353, 1360, 52 USPQ2d 1294, 1298 (CAFC 1999), *In re Haruna*, 249 F.3d 1327; 58 U.S.P.Q.2D 1517 (CAFC 2001).

In the present application, by teaching away from applicant's claimed single-layer combination structure disposed over a substrate, Komatsu's clear preference for a multi-layered laminate structure provides evidence of non-obviousness of applicant's claimed invention.

For all of the foregoing reasons, applicant respectfully requests reconsideration and withdrawal of the Examiner's rejection of claims 53-54, 56-58, 60 and 66.

Section 103 Issues

As noted above, in item 4 of the Office Action, the Examiner rejected claims 53-54, 56-58, 60 and 66 under 35 USC 102(e) as anticipated by, or in the alternative, under 35 USC 103(a) as obvious in light of Komatsu et al., U.S. 5,854,708.

Also, in item 6 of the Office Action, the Examiner rejected claims 55, 59, and 61-65 of the present application under 35 U.S.C. § 103 as unpatentable over U.S. Patent No. 5,854,708 to Komatsu et al. ("Komatsu").

Applicant traverses the above grounds of rejection, and requests reconsideration and withdrawal thereof.

The Standard for Rejection under 35 USC 103

In order to determine obviousness as a legal matter, four factual inquiries must be made concerning: 1) the scope and content of the prior art; 2) the level of ordinary skill in the art; 3) the differences between the claimed invention and the prior art; and 4)

secondary considerations of nonobviousness, which in case law is often said to include commercial success, long-felt but unresolved need, failure of others, copying, and unexpected results. *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459, 467 (US 1966); *Miles Labs v. Shandon*, 997 F.2d 870, 27 USPQ2d 1123, (Fed. Cir. 1993).

The U.S. Supreme Court has recently said that “[A] patent composed of several elements is not proved obvious merely by demonstrating that each element was, independently, known in the prior art. . . . Inventions usually rely upon building blocks long since uncovered, and claimed discoveries almost necessarily will be combinations of what, in some sense, is already known. *KSR v. Teleflex*, 127 S. Ct. 1727, 1740-41, 82 USPQ2d 1385, 1396 (S.Ct.2007)

Applicant respectfully suggests that an Examiner must provide a convincing reason why he or she feels that it would be obvious to modify the Komatsu reference in order to derive the single-layer structure claimed by applicant, especially where such a structure is contrary to Komatsu’s actual disclosure. “Rejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” (*In re Kahn*, 441 F. 3d 977, 988 (CA Fed. 2006) cited with approval in *KSR v. Teleflex*, *supra*.)

The U.S. Supreme Court has also stated that a factfinder should be aware of the distortion caused by hindsight bias and must be cautious of arguments reliant upon ex post reasoning. See *Graham*, 383 U. S., at 36 (warning against a “temptation to read into the prior art the teachings of the invention in issue” and instructing courts to “guard against slipping into the use of hindsight”. *KSR v. Teleflex*, *supra*.

Applicant respectfully suggests that when used for cleaning air, as claimed, applicant's single-layer structure is far superior to the laminate disclosed by Komatsu. Applicant further respectfully points out that unexpected results may occur more easily in the relatively unpredictable chemical arts than in the mechanical arts. By placing all of the different components in close proximity to one another in a single layer, applicant's invention provides improved structure useful for cleaning undesirable contaminants from air, and this structure functions significantly better for the purpose of cleaning air than the anti-fog structure disclosed by Komatsu. For example, one of the important purposes of the claimed invention is to effectively oxidize NO_x into a harmless reaction product such as nitric acid (HNO₃), see page 1, line 21 of the specification, and another is to eliminate organic contaminants such as bacteria or the like. The claimed single layer structure is particularly effective for these purposes and is not suggested by or obvious in view of Komatsu's multi-layer structure.

Applicant respectfully points out that the laminated structure of Komatsu actually shields (masks) the beneficial photocatalytic material below a surface layer of silicon dioxide. While applicant readily admits that the external silicon dioxide layer of Komatsu is taught as being porous, it must be realized that even a porous external silica or alumina layer will have some blocking effect, and will have some finite tendency to repel organic material.

In contrast to the laminated anti-fog material of Komatsu, applicant's claimed structure traps ambient organic material in a single exterior layer which contains photocatalytic material which is not masked by any cover layer.

Applicant respectfully points out that Komatsu's primary focus is to function as an anti-fog element, as reflected by the title. The photocatalytic material is only included as a secondary feature, to degrade waxes (such as car wax) and other organic material which inadvertently

becomes trapped in the porous surface, in order to make the hydrophilic anti-fog properties of the external SiO₂ layer last over time.

In contrast to the teaching of Komatsu, the primary focus of applicant's claimed invention is cleaning organic materials out of the air and breaking down such materials through photocatalyzed reactions, and for this reason, applicant's claimed method uses a structure having photocatalytic material in the exterior layer of the material being used, the photocatalyst disposed in close proximity to the other components of the single layer. It will therefore be seen that applicant's structure and method is therefore not taught, suggested or rendered obvious by any teaching of Komatsu, whether considered individually or in any reasonable combination with the other references of record.

Applicant respectfully submits that the Examiner has not provided a convincing or persuasive reason why it would be obvious to a person skilled in the relevant art to forsake the teaching of Komatsu to use a laminated multi-layer with an external coat of SiO₂ and instead, to combine three (or more) different components in a single layer as claimed by applicant.

The unobvious effectiveness of the claimed invention for cleaning air (removing harmful compounds in the air such as nitrogen oxides, ammonia, and sulfur dioxide by decomposing same with the claimed composite material) is shown with reference to some examples in the present specification.

For example, the experiments described as Evaluation test 1 in the specification (page 40, line 10 – page 48, line 32) tiles having titanium dioxide with alumina, strontium oxide or barium oxide were prepared (referred to as the Ti/Al tile, the Ti.Sr tile and the Ti/Ba tile). As a comparison, a tile having only titanium dioxide was also prepared, and all tiles were placed in the apparatus of Fig. 4 and brought into contact with NO gas, and UV light from lamp 20. Fig. 5

shows the NO₂ and NO_x concentrations in the air passed through the apparatus, with the concentration of NO_x being a sum of NO and NO₂ concentrations. With the Ti/Al, Ti/Sr and Ti/Ba tiles the total concentration of NO_x is lower than that of the comparative tile. According to this result, NO gas is decomposed mainly with the photo-excited titanium dioxide into nitric acid (HNO₃) through NO₂ as explained in the specification, page 43, line 29 – page 44, line 22, and is done more effectively than with the comparative tile. Again, it is an important purpose of the claimed invention to effectively oxidize NO_x into a harmless reaction product such as nitric acid. In contrast, NO₂ easily escapes from the surface of the comparative tile without being decomposed into nitric acid. As explained in the specification, the presence of alumina, strontium oxide or barium oxide may keep the NO₂ on the tile surface until it can be decomposed with the titanium dioxide. While the discussed experiment does not involve component (iii), it does prove the advantages brought about by the combination of components (i) and (ii) within a single layer, and shows the interesting role of the component (ii).

Table 3 of the present specification further shows the advantages of the claimed three-component photocatalytic layer (see the tiles of Exs. 6, 7), e.g., these tiles had a grade “6” hardness, whereas the two references tiles in the Table 3 only have “4” grade as Mohs hardness.

Still further, the composite layer involved in the claimed method has a self-cleaning property such that it is easily cleaned with water such as rainfall. See page 11, lines 10-30 and page 16, lines 23-30 of the specification.

Applicant respectfully submits that the differences between the claimed invention and the cited references are substantial and significant, and therefore, applicant’s invention is non-obvious as compared to the respective teachings of the references.

Although applicant traverses the Examiner’s rejections as discussed above, for the sake

of expediting prosecution of the application, independent claim 1 has been amended to further define that components (i), (ii) and (iii) are all situated within said surface layer which is provided as a single surface layer, such that all of said components are in close proximity to one another within the single surface layer. No such structure is disclosed or suggested by Komatsu.

For all of the foregoing reasons, applicant respectfully requests reconsideration and withdrawal of the rejections of claims 53-66 under 35 USC 103(a).

Applicant respectfully suggests that other limitations in the dependent claims are not met by Komatsu, but they need not be argued in view of the foregoing deficiencies in Komatsu. The Applicant respectfully submits that the Examiner's rejections under 35 U.S.C. §§ 102 and 103 should be withdrawn.

Guidelines Regarding Official Notice

On page 3 of the Office Action, in the context of discussing a rejection under section 102, the Examiner states “ When the examiner has **reason to believe** that the functional language asserted to be critical for establishing novelty in claimed subject matter may in fact be an inherent characteristic of the prior art, the burden of proof is shifted to applicant to prove that the subject matter shown in the prior art does not possess the characteristics relied upon”, citing *in re Fitzgerald*, 205 USPQ 594 (CCPA 1980). (emphasis added by applicant)

Applicant respectfully points out that the Examiner has not established what specific reason(s) he has to believe that applicant’s cleaning method inherently results from the use of Komatsu’s structure, even though Komatsu’s multiple-layer structure is structurally distinct from the claimed invention involving a photocatalytic layer with three mixed components therein. Applicant respectfully suggests that the Examiner **appears to be taking official notice** that

applicant's cleaning method is inherently results from using Komatsu's structure.

The USPTO's guidelines, regarding when official notice is proper, have recently been revised, and are set out in MPEP 2144.03. Applicant briefly summarizes pertinent excerpted sections of MPEP 2144.03 hereinbelow, in an effort to assist the Examiner.

A. Official notice unsupported by documentary evidence should only be taken by the examiner where the facts asserted to be well-known, or to be common knowledge in the art, are capable of instant and unquestionable demonstration as being well-known. It is never appropriate to rely solely on "common knowledge" in the art without evidentiary support in the record, as the principal evidence upon which a rejection was based.

B. If Official Notice Is Taken of a Fact, Unsupported by Documentary Evidence, the Technical Line Of Reasoning Underlying a Decision To Take Such Notice Must Be Clear and Unmistakable
Ordinarily, there must be some form of evidence in the record to support an assertion of common knowledge. The applicant should be presented with the explicit basis on which the examiner regards the matter as subject to official notice and be allowed to challenge the assertion in the next reply after the Office action in which the common knowledge statement was made.

C. If Applicant Challenges a Factual Assertion as Not Properly Officially Noticed or not Properly Based Upon Common Knowledge, the Examiner Must Support the Finding With Adequate Evidence
If the examiner is relying on personal knowledge to support the finding of what is known in the art, the examiner must provide an affidavit or declaration setting forth specific factual statements and explanation to support the finding. See 37 CFR 1.104(d)(2).

Applicant respectfully suggests that the Examiner's implicit assertion that, in his view, applicant's cleaning method inherently results from using Komatsu's structure, amounts to the Examiner having taken official notice of such assertion. Applicant further suggests that this implicit assertion fails to meet the standard set out in MPEP 2144.03. The purported 'facts' noticed by the Examiner are not well known in applicant's claimed context and combination; in fact it is applicant's understanding and belief that they were (prior to applicant's invention) unknown in such context and combination. Applicant therefore respectfully challenges the Examiner's implicit assertion that applicant's cleaning method inherently results from using

Komatsu's structure, and respectfully requests that the Examiner provide some documentation to support this asserted belief.

Conclusion

Applicant respectfully suggests that as presently amended, all of the pending claims are believed to be allowable. It is applicant's contention that no possible reading of the references, either singly or in any reasonable combination, can be viewed as teaching applicant's claimed invention.

For all of the above mentioned reasons, applicant requests reconsideration and withdrawal of the rejection of record, and allowance of the pending claims.

Applicant respectfully submits that all of the above amendments are fully supported by the original application. Applicant also respectfully submits that the above amendments do not introduce any new matter into the application.

Favorable reconsideration is respectfully requested.

Respectfully submitted,



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